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The
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THE
ARTIFICIAL
NAUHEIM BATH
ITS
USES, METHODS AND RESULTS

BEING A COMPARISON OF THE NATURAL WATERS
OF BAD-NAUHEIM WITH OTHER ARTIFICIAL
CARBONATED WATERS AND THOSE PRE-
PARED ACCORDING TO THE SYSTEM
ERLINGER, AS WELL AS A RESUME
OF THE TREATMENT ADMINIS-
TERED AT BAD-NAUHEIM,
GERMANY.



THE NAUHEIM BATH
(System ERLINGER)
135 WEST 45TH STREET
NEW YORK CITY

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THE ARTIFICIAL NAUHEIM BATH

THE treatment of diseases by baths and *Introducto* mineral waters dates back to antiquity. But although the medical profession has from time to time conceded some therapeutic value to one spring or another, the consensus of opinion has always been that nature can do nothing which the pharmacist cannot duplicate. A marked exception to this general rule are the baths at Nauheim. Since 1835 the baths have been used in a variety of affections, viz.: rickets, the scrofulous diseases, gout and rheumatism, without, however, attracting much notice. The first scientific treatise on the Nauheim Baths was published in 1859 by Dr. Beneke¹ of the Marburg University, embodying the results of eighteen months' clinical experience. In it he says:

"The cases of organic cardiac disease which have resulted from rheumatism or endocarditis furnish no contra-indication to the use of the saline bath. Four cases above referred to of organic cardiac disease belong to this category; in none of these even a single symptom arose

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introductory which could render the continuation of the bath unwise. On the contrary, I have arrived at the conclusion that the saline bath in individual cases, even if it does not produce improvement of the organic lesion, at all events can prevent its increase and relapse. I should not hesitate an instant to bathe persons who in consequence of rheumatism have become afflicted with cardiac disorder, provided that no secondary renal diseases have developed, and I believe that the bath will not prove without service."

Since then the reputation of the bath gradually increased, and became firmly established in 1880, through the skill of the late Dr. A. Schott, and his application of Ling's Swedish exercises. Dr. Theodore Schott has followed his brother and perfected the system.

The beneficial influence exerted by exercises on cardiac hypertrophy and other lesions had been observed by Williams and Hope at the beginning of the present century. Stokes also noticed improvement in many of his patients afflicted with cardiac disease who were devoted to hunting and sport, but he failed to do little beyond observing the fact. Credit is due to the brothers Schott, not so much, therefore, for originality as for devising a system of natural therapeutics based on scientific experiments and observations. It is owing to the fact that the

rationale of this form of hydrotherapy is now *Introductio* clearly understood that it has been possible to obtain similar results to those obtained at Nauheim, by artificial means. Dr. Theodore Schott says: "I wish every medical man to know this treatment, for only the few with big hearts can come to Nauheim; the many must stay at home."

Nauheim is situated at the eastern slope of the *Nauheim* Johannesburg, the last spur of the Taunus mountain, three-quarters of an hour from Frankfort-on-the-Main. The bathing waters of Nauheim contain from 2 to 3% of sodium chloride, 2 to .003% calcium chloride, various salts of iron, above all, very large amounts of carbonic acid gas.

The natural temperature of the water is 82 to 95° F. The waters rise from a depth of 180 meters in a strong column to a height of 56 feet and fall again in a white, seething mass. So richly charged are these waters that the reservoir into which they fall has the appearance of a great mass of clouds.² "Conveyed directly from the main by means of a subterranean pipe, these waters charged with their natural gas are allowed to completely cover the body of the bather. Little bubbles of gas are seen to immediately cover the whole surface of the body. The waters of springs Nos. 7 and 12 escape from a pressure of from 1½ to 2½ atmospheres, and

afford a surf bath which compares accurately with the strongest surf bath of sea-water."

That the baths of Nauheim are of decided benefit in chronic heart disease is now established beyond question. Schott succeeded in arousing the interest not only of German physicians, but from England, France, and America eminent men in the profession came to study his methods and see with their own eyes the marvellous cures effected. In England we find W. Henry Thorpe one of the earliest and most ardent advocates of Schott's methods. His publications (1884)⁴ were soon followed by many others. William Armstrong, M.R.C.S., says:⁵

"I am convinced, from the results which I have myself seen, that in the Nauheim treatment we have a combination of powerful therapeutic agents which may be used consistently, with markedly beneficial and often with brilliant results, in many distressing cases over which drugs have often had a limited and frequently also only a temporary influence."

So great did the controversy become that *The Times* in 1886 sent a special commission to Nauheim, which reported as follows: ⁶"Nauheim is much fortunate in its possession of richly saline and gaseous waters; that these have a marked influence for good or for evil, according to skill in their use, upon the vascular system; that in a

carefully regulated and supervised 'Wieder-Nauheim standsgymnastik' or resisted movements there is likewise a powerful means of influencing the heart's action, but that, as in the case of other powerful agents, the physician must be content to observe their effect slowly develop and not by rapid and extraordinary shrinkage in the cardiac area, which can only be attained as a rule, if attained at all, by imposing a strain upon the patients which it is well to avoid. If these conclusions be correct it is, moreover, desirable, in the interest of the public, the profession, and of science, that a 'system' about which there is absolutely no more mystery than there is in the skilful use of any remedial means whatsoever, and which with instruction and observation should be quite as capable of utilization by any practitioner as digitalis or any other cardiac agent, should receive consideration from those in this country whose education, opportunities, and status entitle them to speak with authority."

In this country Babcock, Solis-Cohen, Heine-man, and Theodore Schott with their contribu-tions to medical literature gained many follow-ers.

On entering the bath the patient experiences *Effects of* a sensation of chilliness more or less pronounced *the Bath* according to the temperature of the water, which in about a minute is replaced by one of agreeable

Effects of warmth and well-being. Most patients coming from the Bath plain of a sensation of weight or oppression experienced as a rule in the chest, though in some this feeling is more pronounced in the epigastrium. This sense of oppression disappears after the first few baths. The pulse is slowed, but increased in volume and strength. If irregularity has existed, it disappears or becomes less marked. The area of cardiac dullness is diminished, and the heart sounds become clearer and stronger. The previously accentuated second pulmonary sound becomes less marked, and the second aortic sound more intense. The respiration becomes easy, and is slower and deeper. This beneficial effect in the circulation does not disappear at once after the bath, but persists for a considerable time subsequently. The improvement in the circulation is also indicated by increased diuresis.

Aug. and Theo. Schott endeavored to substantiate their claims both experimentally and by accurate clinical determinations. Thus Aug. Schott, in the laboratory of Prof. Heidenheim at Breslau, subjected shaved rabbits to baths in a tub, so constructed that by means of a movable partition it was divided into two chambers or compartments. One was filled with plain, the other with saline water, both of the same temperature. The animal was first placed in a

plain water bath, and the effects of the blood-pressure noted by means of a mercurial manometer introduced into the trachea. Then little by little the movable partition was raised, thus permitting the admixture of the salt solution with the plain water, and the effects were again carefully observed. It was thus noted that as the surface of the body became subjected to the influence of the salt solution, the blood-pressure rose 5 to 10 mm. with a 10% salt solution. Carbonated water increased blood-pressure 10, 20 and even 30 mm.

The correctness of these observations has been further corroborated clinically by followers of Schott, by the use of Basch's sphygmomanometer and the instruments of Potain and Oliver. Despite all this evidence, there are those who have doubted and still doubt the correctness of the above statements. O. Reissner and G. Grote⁷, in a series of 43 patients treated with Nauheim thermal and Sprudel baths, found (using Gaertner's tonometer) variations in blood-pressure of ± 5 mm. and even less in 18 cases, diminution 14 times and increase 11 times. The apparent diminution in the area of cardiac dulness they attribute to increased expansion of the lung, yet in their conclusions they state that the heart is strengthened and develops greater energy and that intra-cardial and peripleural

Effects of congestion is diminished. If we compare Reissner and Grote's irreconcilable results of these few cases with those obtained by Prof. Theo. Schott⁸, we are compelled to attribute it to a lack of technique in the first-named observers. Indeed, there are so many details in the proper use of Gaertner's tonometer which must be strictly observed that it is possible to obtain trustworthy results only after extended practice. Schott found that the average increase of blood-pressure equaled 30 mm. Hg. In some cases, however, little increase in pressure was noted, and even a diminution. If we consider that the factors concerned in maintaining the blood-pressure are the *vis a tergo* (expulsive power of the heart), a system of elastic tubes and the peripheral resistance, we can readily see how grave a symptom such a fall in blood-pressure is. We are dealing either with cases of advanced myocardial degeneration or arteriosclerosis. Prof. Schott states that with a tonometric pressure as low as 65 to 60 mm. of Hg. therapy is of no avail, and that the baths and exercises are absolutely contra-indicated.

The old controversy regarding the contraction of the area of cardiac dulness has also been revived in Reissner and Grote's article. Schott tried to meet this objection at the outset by improved methods of examination. Auscultatory

percussion, which appeared to verify his statements, has been always doubted as trustworthy, and was finally entirely disproved by F. Moritz⁹. It was not till the introduction of X-rays that the matter was settled. Schott¹⁰ gives the results of his control test with some radiographs of the heart-shadow before and after the bath. But although functional results are for the most part only aimed at, in certain cases an absolute cure has been effected. Eichhorst¹¹ reports the case of a man with pronounced mitral insufficiency cured in two seasons at Nauheim, so that the patient was accepted by a very strict life insurance company.

The theory elaborated by Prof. Schott is that *Physiology of the chlorides of sodium and calcium, and the carbonic acid gas passing through the epidermis, Nauheim stimulate the sensory nerve endings, and, by reflex action on the cardiac nerves and muscle, cause the heart to beat more forcibly and less rapidly.* In the opinion of John F. H. Broadbent, this explanation is insufficient to account for the diminution in size of the left ventricle. He believes that as a result of the cutaneous stimulation there is a dilatation of the peripheral blood-vessels, with a consequent diminution of peripheral resistance and relief to the left ventricle of the heart, allowing it to contract better. R. Saundby¹¹ agrees with Broadbent, that the

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Physiology principal effect is on the peripheral circulation, of the and that the heart becomes slower according to Nauheim Marey's law (heart-beat varies inversely as the Bath pressure). Bezley Thorne in his book says: "The carrying power of the peripheral vessel is increased and a sense of warmth in the extremities and on the surface of the body is experienced. The general arterial capacity, systemic and pulmonic, is increased, and without the loss of blood the relief of a general bleeding is afforded to an overloaded and laboring heart."

If we stop for a moment to consider a few facts in physiology, we will see that either explanation is insufficient in itself. Two-thirds of the entire blood in the body can be harbored by the capillaries of the skin, hence a diminution of peripheral resistance without stimulation of the heart ought to cause a fall in blood pressure. It is necessary, therefore, to assume that the heart is reflexly stimulated through the cutaneous nerves so as to counterbalance this diminution in pressure. On the other hand, as Broadbent correctly points out, Schott's theory by itself offers an inadequate explanation.

The various circulatory phenomena of the Nauheim bath can be considered, therefore, as the result of cutaneous stimulation in part of the peripheral nerve endings directly, and in part as a reflex stimulation of the cardiac nerves. Rec-

ognizing this fact, various observers have at- *Physiology* tempted to obtain similar results by different *of the* cutaneous stimuli. Thus Albert Abrams¹² *Nauheim* states that mechanical stimuli to the skin, such *Bath* as friction, have the same result as the carbonated bath. Engelman, cited by O. Reissner and G. Grote⁷, attributed the entire result to the sool-bath. These statements are true only in part. Friction and sool-baths can cause a hyperemia of the skin, but they are able to affect the heart but little if at all. That carbon dioxide is a powerful nerve stimulant we know from physiology. The cerebral, respiratory and cardiac centers are regulated by the amount of carbon dioxide in the blood. Quoting from Foster's *Physiology*, "The effect of venous blood, then, is to augment all those natural explosive decompositions of the substance of the central nervous system which give rise to respiratory impulses; it increases their amount, and also quickens their rhythm." "This is caused mainly by direct stimulation of the spinal bulb, but also in part by stimulating the peripheral end of nerves in different parts of the body. The effect on the heart is directly opposite, causing it to beat more slowly and contract more forcibly." "The rhythm of the heart is slowed on the one hand and the output at each beat, as shown by direct observation with the cardiometer, is increased."

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Indications George L. Peabody correctly observes¹⁴ for the Bath "that Nauheim has suffered in two ways in its literature: at the hands of its advocates, who claim too much for it, and at the hands of its critics, who often without sufficient investigation indulge in *a priori* condemnation of it." The claims of many of Schott's followers are extravagant, and thus cases which according to Schott are unsuitable for treatment have been subjected to Nauheim baths, with disastrous results. Schott expresses the following opinion in reference to indications and contra-indications:

"Cases which are likely to derive most benefit from this treatment are cases of cardiac dilatation due to overwork or mental worry; cases of mitral disease where the right ventricle is beginning to give way and compensation threatens to break down. In cases of adherent pericardium with symptoms of cardiac embarrassment it should be tried.

"Cases of aortic incompetence are unsuitable unless symptoms of right ventricle failure have supervened.

"Cases of aortic aneurism are unsuitable, as the sudden and frequent changes in the blood-pressure can but do harm.

"In cases of true angina pectoris this treatment must be practised, if at all, only with the greatest caution. It may be of service in re-

lieving the embarrassment of the heart by *Indications* vascular dilatation, and thus act like nitrite of *for the Bath* amyl or nitroglycerine; but there is a risk of syncopal attacks, in which a fatal issue might result.

"In cases of fatty heart — that is, fatty infiltration, not fatty degeneration — accompanying general obesity, this treatment should be beneficial, and is not attended with danger if carefully carried out."

In his earlier writings Schott states that the baths are contra-indicated in angina vera and advanced arteriosclerosis on account of the danger of embolism or apoplexy. This statement, although correct, is based on faulty deductions. In a later writing⁸, after extended tonometric observations on patients, he remarked that a decided lowering of blood-pressure should always be regarded as a serious symptom. This lowering in blood-pressure occurred in cases of advanced arteriosclerosis, myocarditis and aneurism of the heart and aorta. These results agree with those of O. Reissner and G. Grote,⁷ who therefore incorrectly advocated the use of the bath in arteriosclerosis, aneurism and contracted kidney.

The question naturally presents itself, Why does the blood-pressure increase in one class of cases and diminish in another? Blood-pressure

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Indications depends on three factors, the force of the ventricular systole, the elasticity of the arteries and the resistance in the capillaries. Manifestly, with the peripheral resistance reduced by the dilatation of the capillaries, blood-pressure ought to fall unless counterbalanced by increased force of the ventricular systole. A degenerated heart-muscle (myocardial or parenchymatous fatty) can respond but little if at all to stimulation, nor are rigid tubes of a case of arteriosclerosis able to maintain a pressure during the cardiac rest following the ventricular systole. The activity of the heart-muscle depends on the blood supplied to it by the coronary arteries. It is evident, therefore, that a lowering of blood-pressure will diminish the amount of blood flowing through the coronary arteries with a consequent anaemia of the heart-muscle, which may result in an attack of syncope or angina pectoris due to the stopping of the heart's action. It is for this same reason that cases of angina pectoris vera caused by sclerosis of the coronary arteries, which are generally associated with myocarditis and arteriosclerosis, do not stand the baths.

Diseases of Joints. — A certain group of cases, whether rheumatic, gonorrhoeal, tubercular or specific in origin, is characterized by localized circulatory disturbances of the affected joints. They are enlarged, hyperaemic, with exudations

either in the joint cavity or the periarticular *Indications* structure; bands and adhesions of inflammatory *for the Bath* origin limit the motion and cause an impairment of function which may border on absolute disability. These cases can be vastly improved by the warm carbonated baths. The general circulation being improved, the congestion and enfeebled circulation of the lymphatics in the joint are relieved, exudates diminish and are absorbed, inflammatory bands and adhesions become softened and disappear in part. It is manifestly absurd to suppose that a *restitutio ad integrum* can occur where, either from tuberculosis or syphilis, the cartilages and articular ends of joints have been destroyed. Neither can advanced cases of arthritis deformans, with bony ankylosis, be benefited. Where, however, a bony ankylosis does not exist, where pain and limitation of motion are due to a thickened capsule, inflammatory bands and adhesions, much may be done in restoring function to the affected limb by a systematic course of bathing, combined if necessary with massage.

Diseases of Women. — Beneke¹ was the first to call attention, in an article published in 1859, to the utility of these baths in gynecological practice. This, however, with other conservative methods, had fallen into disfavor through the apid advances made in operative gynecology.

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Indications S. W. Bandler, in a series of cases published *or the Bath* in the *Medical Record*,¹⁶ describes the good results which may be attained with baths alone. In 20 selected cases there was marked improvement in all. There were treated 19 cases of hysteroptosis with inflammation, congestion and exudates in the tubes (pyosalpinx) and parametria; one case of hydrosalpinx. One case which was operated, at the request of the patient, after nine baths, showed marked softening of the adhesions, thus greatly facilitating the operation. We can see from this that the baths are a valuable adjuvant, even in cases which are subsequently operated.

Kustner and Herrmann have shown that *restitutio ad integrum* is possible even after pus has collected in the tubes. The danger of delay is not great, as it has been shown by Kiefer and Wertheim that the pus is sterile after one year. On the other hand, patients who are operated, aside from the fact that they become sterile, invariably are invalids for the rest of their lives.

Bandler ascribes the effects of the bath to, first, increase in the number of red blood-cells; second, stimulation of the nervous system; third, resorption of exudates; fourth, improvement of the circulation and diminution of congestion.

The baths are indicated in "amenorrhœa, maldevelopment of the genitalia, endometritis,

subinvolution and chronic metritis, after the *Indications* subsidence of acute symptoms in all cases of *for the Bath* pelvic inflammation, either simple or purulent, affecting the uterus, appendages and perimetrium."

Diseases of Metabolism. — Many attempts have been made to combat the discomforts and danger of adiposity by the use of drugs, mineral water, special diet, exercises, etc. Though each system can record cures, i.e., reduction of body weight, it has happened not infrequently that the subjects of such cures lose weight only to find themselves worse off than before. Severe purgation by the use of the waters of Marienbad, Carlsbad, Tarasp, etc., although popular at one time, is no longer so. The rapid diminution in weight which occurs is always associated with a marked loss of strength. General debility, chlorosis and anaemia are often caused by such drastic purgative methods. Even the use of the milder water of Kissingen, Kreuznach, etc., is finding fewer adherents. The late Dr. Beneke was the first to show the fallacy of such severe procedures.

The various diets, as in the Harvey-Banting system, Ebstein, and others, are all in reality starvation cures. They result in a loss of albuminates, digestive disturbances, and nervous disorders.

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Indications Oertel's system is based on the erroneous belief that it is possible to diminish the volume of the blood by regulating the amount of fluids taken. Unpleasant as the excessive weight is in pronounced cases of adiposity, the disease itself does not actually call for medical interference. There is, however, one complication to which sufferers from this disease are very liable, and which is most frequently the cause of their consulting a physician, namely, the fatty heart. It is particularly in cases of this kind that disastrous results are experienced from the above-mentioned forms of treatment. The heart-muscle instead of being strengthened is invariably weakened, and the number of pounds lost in weight cannot compensate the patient for the dilated and feeble heart-muscle which he has acquired as a result.

Theo. Schott in the *Medical Record*¹⁷ gives his views regarding the treatment of fatty heart. The aim is to diminish the body fat without much loss in weight, to cause a gradual consumption of fat, while at the same time the muscular substance is not only spared but frequently augmented and the volume of blood increased. Diet must not be disregarded, but should not be carried to an extreme.

Such patients commence with saline baths, gradually increased in strength, soon followed by Sprudel and Sprudel-strombäder. Unless

contra-indicated by chlorosis and anaemia, rheumatic or arthritic complaints, baths of low temperature are used — 88° to 86° F., reduced to 77° to 76° F., for ten minutes, and never more than 20 minutes. Cases of fatty heart associated with chlorosis and anaemia are especially benefited.

The success which has attended what might be called the test cases of obesity has been so great that now the Nauheim baths have become more generalized in their application to all varieties of obesity. True, the immediate results are not so marked, but they are lasting, and with the improvement in the circulation the perverted metabolism is gradually corrected and overcome.

Gout. — In this disease the baths accomplish not only a relief of one of its symptoms, the joint manifestations, but the disease itself is ameliorated and frequently cured. Nothing further need be said of the use of the bath in gouty arthritis, as the same applies here which has already been considered under the heading of Diseases of Joints. Gout being a constitutional disease, it is not surprising that, by baths which improve the circulation and the metabolism of the body tissues in general, the underlying cause of the disease may be removed.

Diseases of the Nervous System. — No less an authority than Prof. Erb of Heidelberg repeat-

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Indications edly mentions in his works the salutary effects of the Bath exercised by the Nauheim baths in diseases of the spinal cord. Locomotor ataxia seems to be particularly benefited by it. The word "seems" is used very properly here, since it is impossible to be certain of any remedy in a disease like this, which is subject to great remissions as well as exacerbations. Suffice it to say, that many sufferers from this affliction are enabled by a course of baths during the summer to attend to their vocations the rest of the year. Less brilliant results are recorded in the treatment of paralysis agitans and multiple sclerosis. According to Groedel, paralyses resulting from cerebral apoplexy, or those of peripheral origin caused by diphtheria, typhoid fever, etc., are also benefited. Recovery from the various forms of neuritis, either localized or multiple, is greatly hastened by a course of baths. In the last named group of cases it is of advantage to combine the baths with massage and electricity.

In neuralgias, brachial and intercostal, sciatica, etc., baths of 93° to 95° F., with 2% salt, usually effect a cure. In the more obstinate cases effervescent baths must be resorted to.

Of the functional diseases of the nervous system, neurasthenia is the one most benefited by the Nauheim baths. Although primarily an exhaustion of the spinal and cerebral centers, its

most important manifestations are an insufficiency and weakness of the unstriped muscular fibers of the blood-vessels and gastro-intestinal tract. The circulatory disturbances, characterized by a feeble and irregular pulse, cold and bluish extremities, attacks of cerebral congestion or anaemia; the digestive disturbances, such as anorexia, flatulence, and constipation, can all be explained by a loss of tone of the unstriped muscles. Rest will do some good in these cases, nerve-tonics none. Stimulation of the already exhausted nerve-centers to meet the increased demands of the strain only serve to intensify the evil; and the use of nerve-tissue builders (such as the glycero phosphates) is at most only problematical. Correct the tone of the blood-vessels and of the muscular coat of the gastro-intestinal tract, the body again will be able to regulate the amount of waste and repair, and thus break the link in this vicious circle.

Hydrotherapy has always occupied a high place in the treatment of this disorder, and is in itself quite sufficient to accomplish a cure. It is needless, therefore, to go further into the physiology of a system which had been sufficiently expounded already by such men as Winternitz, Mathes and Baruch. We wish merely to affirm that the carbonated bath acts much in the same way as the customary hydrotherapeutic meas-

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dications — with this difference, that results are more marked, more speedily accomplished and with less inconvenience to the patient; the explanation being that low temperatures such as are used in the treatment of neurasthenia are better borne if the water is carbonated (i.e., the patient does not feel the cold as acutely), and that without any sensation of depression the nervous system is stimulated.

Closely allied and in part identical with neurasthenia are the cardiac neuroses. Theo. Schott,¹⁸ in a very able treatise, has attempted to institute some order in this chaos of functional cardiac diseases. He classifies them as sensory and motor, to which Fothergill adds a third class, neurasthenia cordis. The sensory neuroses comprise (a) pseudo angina seu angina nervosa, (b) angina vaso motoria, (c) angina pectoris vera. Whereas the vasa motor form of angina presents little difficulty in distinguishing from the true form, the nervous form of angina has been and is still the great stumbling-block in diagnosis. How difficult the diagnosis occasionally is we can best appreciate by reading Osler's well-known monograph on angina pectoris.¹⁹ In the use of the Nauheim baths it is essential to distinguish one variety from the other, since in angina pectoris vera the treatment is almost contra-indicated, whereas in the other two varie-

ties incomparably good results are obtained. It *Indication*, is of course possible that the Nauheim baths may *for the Bath* be used with advantage in the true form of angina, but the greatest caution must be exercised, and the results of the baths should be controlled by tonometric measurements. The other cardiac neuroses, viz., the motor form and neurasthenia cordis, present no difficulty in diagnosis, and are eminently suited to this treatment.

Other functional diseases for which the Nauheim treatment is suited are hysteria, chorea, and the so-called traumatic neuroses and railway-spine.

Scrofula and Rickets. — Of these two diseases the former is almost entirely unknown in this country, the latter occurs chiefly among the foreign-born population. Aside from the so-called scrofulous glandular enlargements, which are now considered to be tubercular, there is a type of this disease described in which the tubercular element is not at all proven. Jules Comby²⁹ says concerning this class:

"We do not claim as scrofulous in their nature any of the deep lesions of the skin, mucous membranes, bones or articulations, which might in former times have been referred to this disease. But with all these removed there still remains a special morbid temperament, often hereditary but sometimes acquired, which is called by some

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Indications lymphatism, by others scrofula. . . . These children are all weak, soft and without energy. They are subject to obstinate and recurring cutaneous eruptions, such as eczema, acne, etc.; they have thick lips, a wide and flattened nose, flabby cheeks, blear eye; there is often a discharge with excoriation at the openings of the nostrils, the lymphatic glands are enlarged, the flesh is soft and flabby, and the lymphatic apparatus seems engorged with fluid."

This type, the scrofulosis proper, and rickets are diseases of malnutrition. Here the baths do not exert a specific influence, but by the improvement in the metabolism of the body tissues, anaemia, and enfeebled circulation accomplish a cure by the general tonic effects exerted.

Typhoid Fever and Renal Diseases Since it is possible to carbonate baths artificially, their application has become more ex-

tended. Robert Coleman Kemp¹⁹ says: "We believe them [the carbonated baths] of great value under many conditions in addition to those for which they are employed at Nauheim itself. . . . They embrace a wider field in their therapeutical application than has been attributed to them. Thus they are useful to reduce temperature, as in typhoid fever, and can be applied even to the domain of surgery."

In typhoid fever they were first applied by William H. Thomson, in 1898, at Roosevelt

Hospital.²⁰ Their advantage over the Brand *Typhoid* bath is that they are more stimulating, and that *Fever and the low temperature of the water is endured Renal without a marked sensation of chilliness so often Diseases complained of by patients tubbed after Brand's method.* Kemp further discusses the application of the bath in renal insufficiency with uræmic symptoms. The baths are given, at a temperature of 98° to 95° F., from 3 to 10 minutes. In the parenchymatous form of nephritis the baths certainly help to bridge over crises of otherwise fatal uræmic attacks, but they cannot be considered in any way curative. It is rather in the early stages of interstitial nephritis that they are of most service. The hypertrophy of the heart is for a time at least prevented, and in the incipient stages ameliorated. In the later stages of the disease, when the hypertrophied heart no longer is compensated and symptoms of chronic uræmia supervene, the baths are contra-indicated. The aim is not to increase diuresis but to counteract the cardiac hypertrophy, and relieve it to a certain extent if already existing.

The plan followed by Theo. Schott, which is *Methods of the most satisfactory of the methods employed, Administer will be briefly outlined here.* The first bath *ing the* (thermal sool-bath) is supplied by the waters of *Nauheim* spring 7, taken from the receiving basin. This *Bath* contains very little carbon dioxide, 2.18% so-

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of dium chloride, and 0.17 calcium chloride. In certain cases Schott prefers to commence with the still weaker saline baths (1% sodium chloride, or .001% calcium chloride). The natural temperature is 88.8° F., but this is raised to 92-95° F. Temperatures above that of spring 12 (95.5° F.) are not suitable for heart patients. The duration of the bath is at first 6 to 8 minutes, while the temperature is gradually lowered 1° F. at a time. The bath should be discontinued every second or third day, later on every fourth or fifth day. The percentage of salts is gradually increased by the addition of mother-lye; the calcium chloride, which is the most important ingredient, may eventually reach 0.5%. By this time, the temperature having been gradually lowered, and the duration of the bath prolonged to not more than 20 minutes, the patient is ready for a course of Sprudel baths, either from spring No. 7 or 12, the former containing the greater amount of carbon-dioxide gas, the latter of salt. In these baths the water is supplied directly from the springs before it has been exposed to the air, so that it appears filled with bubbles of carbon dioxide, which it retains in undiminished quantity.

The baths are taken at first at the natural temperature, and for a short time — about 8 minutes — and as they are continued the temperature is lowered in the same cautious way and the dura-

tion similarly prolonged. The saline contents *Methods of* may also be increased by the addition of mother-*Administer* lye. The temperature is seldom if ever reduced *ing the* below 80° F., and the duration should never be *Nauheim* longer than 20 minutes. The final and most *Bath* powerful form of stimulation is the Sprudel strombad, in which the supply and overflow pipe of the bathtub are left open, so that, in addition to the fresh supply of carbon dioxide, the shock of the running water against the body is experienced. These are not given to many persons in their first season at Nauheim. During the entire period of the administration of the baths their effect should be watched with care, and the character of the respiration, condition of the pulse and heart-sounds noted.

After each bath the patient, having been well rubbed, should rest at least one hour. The food and mode of life are regulated as is usual with heart patients. An ordinary course of baths at Nauheim is estimated at about 21 or 25, extending over a period of four or five weeks. Where a series of 25 baths does not attain the desired effect, it is often advisable to supplement the first course of baths by a second shorter one (10-15) after an interval of from three to four weeks. Heart patients and others suffering from chronic ailments may resort to the cure every year for almost an indefinite period of time.

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Methods of Administer- The following rules should be observed:*

- Nauheim Bath* 1. Baths should be preferably given in the morning, and always on an empty stomach.
2. The patient should not be allowed to exert himself.
3. The entire body must be immersed.
4. The attendant should keep himself informed continually as to the character of the pulse.†

The air of the bath-room must never become surcharged with carbon dioxide. In bathing children in full-sized tubs care must be taken that not too much carbon dioxide is inhaled. To get rid of the surplus of carbon dioxide, the water should be struck lightly with a towel several times.

Danger Signals. — Cyanosis, dyspnœa or apnoea, inappreciable pulse. On the appearance of any of these, take the patient out of the bath immediately, put him to bed and keep him as quiet as possible. Friction while in the bath is not necessary, but if the fingers and toes become bluish the extremities may be rubbed slightly towards the trunk. Friction should be cautiously employed. Something light and hot

* Modified from Camac.³

† NOTE. — The solution of the carbonic acid gas, being more stable in this artificial bath than in the natural waters of Nauheim, precautionary measures (such as drawing a sheet around the bather), to prevent the inhalation of excessive amounts of the gas, are unnecessary.

(bouillon, milk punch and toasted crackers) may *Methods of*
be taken directly after the bath. If the heart's *Administer*
action is poor, sherry, brandy or port wine may *ing the*
be given after the bath. *Nauheim*

It is in this tentative way that we must proceed *Bath*
in the administration of the baths, adapting them
accurately to the requirements of each patient.

With regard to affections other than those of
the heart, in which the Nauheim baths are ap-
plied, a few general rules will be of service for the
practitioner. Warm baths are used in anaemia,
debilitated individuals (scrofulosis and rickets),
in subacute and chronic rheumatism, the sub-
acute and chronic arthritides, pelvic and abdomi-
nal exudations and inflammations, renal insuffi-
ciency and parenchymatous nephritis.

Cold baths are employed in obesity and fatty
heart, neurasthenia and other functional nervous
diseases.

Interstitial nephritis is treated according to the
rules laid down under circulatory disorders.

Groedel²¹ gives the following directions:

Gout. — In the chronic forms commence with
thermal brine baths at a temperature of 93° to
95° F. These should be increased rapidly in
strength, preparing the patient for the efferves-
cent baths of spring 12 at the natural temperature,
92°. To promote absorption of exudates and
remove stiffness of joints, the current thermal and

Methods of effervescent baths should be employed, supplemented with massage and active and passive motion.

Nauheim Bath In fresh forms of gout 20 to 25 baths often effect a complete cure. After the joint symptoms have subsided cooler baths should be used, reduced gradually to $82\frac{1}{2}$ ° F., followed at the end of the course by frictions with cool water of 65° F. temperature.

In chronic gout cool baths should never be used, and no hardening procedures resorted to.

Arthritis Deformans. — Thermal brine-baths, 93° F., of rather longer duration — 30 minutes — give the best results. Stimulating baths (current, effervescent or cool) should only be used in the senile form of arthritis deformans.

Chronic Muscular Rheumatism. — Strong thermal brine-baths, 94° F., are used first, proceeding rapidly to effervescent brine-baths. The temperature is then gradually reduced to a point where cold-water treatment may be instituted.

Chronic Articular Rheumatism. — Begin with thermal brine-baths and end up with current effervescent baths, 92° F. In severe cases the temperature should not be reduced.

Tabes Dorsalis. — Although as a general rule strong, stimulating baths are not well borne, some good results are obtained with current effervescent baths (strombäder), even in severe

cases. Usually thermal brine-baths, 91° F. with *Methods of 1½% salt*, are employed. The same holds good *Administered for other sclerotic conditions of the cord. In the spastic paralysis cool temperatures should be Nauheim Bath avoided.*

Neuralgias. — Treatment with baths at a temperature of 93–95° F. and 2% salt is often sufficient; the more obstinate cases require effervescent baths from spring 12, at the natural temperature or even warmer. When the pain has entirely disappeared the temperature may be reduced.

Neurasthenia, including Cardiac Neuroses. — Thermal brine-baths, 90° F., of short duration are used first. The temperature is gradually reduced to 75° F.; now and then current thermal baths and current effervescent baths are used.

Theo. Schott¹⁸ adopts the following plan in the treatment of cardiac neuroses: Baths are taken from the reservoir, the temperature not to exceed 90–91° F. and lasting 5 to 8 minutes. Lean and anaemic people, however, may commence with a temperature of 93–95° F. The duration may be gradually increased to 10 to 20 minutes. At first the baths are given every other day, but later on they are omitted every third, fourth or fifth day. Stronger concentrations of salt by the addition of mother-lye are to be avoided as patients become feeble or over-excited.

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Methods of Administration. In this class of patients effervescent and current effervescent baths are indicated. Chorea, hysteria and other functional neuroses are treated Nauheim much in the same way.

Bath Scrofula and Rickets. — Thermal brine-baths from spring 12, often with the addition of mother-lye, are indicated in the stronger children. The more delicate children do not stand the baths well, and are better suited with baths free from carbonic acid, containing 1 to 1½% salt. Occasionally, however, even in the latter class, effervescent baths have a favorable influence on the anaemia of these patients.

Diseases of Women. S. W. Bandler, who has devoted particular attention to the application of carbonated baths in the treatment of diseases of women,¹⁶ advocates the following method. He commences with effervescent baths of half strength carbon dioxide, at a temperature of 92° F. and lasting 8 minutes. The temperature of the bath is lowered on succeeding days (but never below 82° F.) and the amount of carbon dioxide increased. Baths are omitted every fourth day.

After Treatment. In the case of patients suffering either from diseases of the circulatory apparatus or nervous system, it is advisable to supplement the course of baths by a short rest at some quiet health resort. For many sufferers from heart disease a place with a choice of level walks should be se-

lected, and an altitude not exceeding 3000 feet. *After* For obese people, especially those afflicted with a *Treatment* fatty heart, opportunity for mountain-climbing should be afforded. Nervous and anaemic patients do best in high altitudes, 3500 feet or more. These indications can all be readily met by numerous health resorts within a short distance of New York — some places even, such as Lakewood and Atlantic City, being especially suitable for the winter months.

That exercise frequently exerts a beneficial *Resistance* influence on a diseased heart has long been *Exercise o* known empirically. No explanation, however, *Dr. Schott* was offered for this seemingly impossible fact until Ludwig and Lauder-Brunton by a series of experiments explained the physiology of the circulatory phenomena associated with muscular activity. Lander-Brunton showed that massage was followed by an increased flow of blood through the massaged part, and that blood-pressure at first rises and then falls, and that on the conclusion of massage more blood collects in the massaged parts. These experiments were confirmed by Dr. Oliver.²² T. Grainger Stewart²³ concludes that the passive exercises improve the circulation of lymph within the tissues, and bring a larger volume of blood into the muscles. He quotes Ludwig to the effect that the capacity of muscles for blood is equal to

Resistance the combined capacity of the internal organs and
Exercise of the skin.

Dr. Schott The resistance exercises of Dr. Schott consist of a series of slow movements executed by the patient and lightly opposed by the physician or operator. The patient should be loosely and lightly clad, and instructed to breathe quietly. The resistance employed should be small, so that the patient always feels himself the master. There should be no increase in respiratory movement, flushing or pallor. The operator must not grasp or in any way constrict the limbs, but should oppose by the hand held flatly. There are 19 movements. Satterthwaite has modified these and added respiratory resistance movements.*

Rules for the Operator 1. Each movement to be performed slowly and evenly at a uniform rate.

2. No movement to be repeated twice in succession in the same limb or group of muscles.

3. Each single or combined movement to be followed by an interval of rest. Count five.

4. Patient's breathing should not be accelerated.

Avoid:

(a) Dilatation of the alae nasi.

(b) Drawing of corners of mouth.

* Description of exercises from "Chronic Diseases of the Heart," by W. Bezley Thorne.

(c) Duskeness and pallor of cheeks and lips. *Rules for*
(d) Yawning. (e) Sweating. (f) Palpitation. *Operator*
If any of the above symptoms are noted make
a complete interval, or, if excessive, stop the ex-
ercises for the day.

5. Direct the patient to breathe regularly. If he holds his breath, make him count in a whisper.

6. Do not constrict the part that is being moved.

Arm. — (1) Arms extended in front of body *Exercises* on a level with shoulder, hands meeting; arms carried out until in line, and brought back to original position. (2) Arms hanging at sides, palms forwards; arms flexed at elbow until tips of fingers touch shoulder, back to original position; one arm only moved at a time. (3) Arms down, palms forward, arms carried outwards and upwards until thumbs meet over head; back to original position; one arm only moved at a time. Not always advisable. (4) Hands in front of abdomen, fingers flexed so that the second phalanges touch those of opposite hand; arms raised until hands rest on top of head; back to original position. (5) Arms down, palms against thighs, arms raised in parallel planes as high as possible; back to original position.

Trunk. — (6) Trunk flexed on hips, return to original position. Resist with both hands. (7) Trunk rotated to left, to right, return to

Exercises original position. Resist with both hands. (8) Trunk flexed laterally. Resist with both hands. (9) As No. 1, but fists clenched. Resist with both hands. (10) As No. 2, but fists clenched. Resist with both hands.

Large Arm Movements. — (11) Arms down palms against thighs, each in turn raised forwards and upwards until arm is alongside of ear, then turn outwards, and arm descends backwards. Not always safe. (12) Arms down, palms to thighs, both together moved backwards in parallel planes as far as possible without bending the trunk forwards. Not always safe.

Legs. — (13) Thighs in turn flexed on trunk, opposite hand resting on chair. (14) Lower extremities in turn extended fully, and bent on trunk forwards and backwards to extreme limits of movement, opposite hand resting on chair. (15) Legs in turn flexed on thigh, both hands on chair. (16) Feet together, lower extremities in turn abducted as far as possible and brought back to original position, opposite hand on chair.

Hands and Feet. — (17) The arms, extended longitudinally outwards, are rotated from the shoulder-joint to the extreme limits forwards and backwards. (18) The hands in turn are extended and flexed on the forearm to extreme limits, and brought back in line with arm. Resist with both hands. (19) The feet in turn are

flexed and extended to extreme limits, and then *Exercises* brought back to their natural position. Resist with both hands.

As the utility of Nauheim is limited by its *The capacity for accommodating patients and by the Artificial* comparatively brief summer season (not even *Nauheim* considering the fact that with many the question *Bath* of time and money is an important factor) whereas the number of those standing in need of this treatment is legion, it is readily understood that every effort has been used to produce Nauheim baths artificially.

Theo. Schott himself gave various formulæ for preparing carbonated baths of different strengths, the saline constituents being supplied in these baths by the commercial sodium chloride and calcium chloride, and the generation of CO₂ gas being accomplished by the action of hydrochloric acid on bicarbonate of soda. Broadbent, in *The Practitioner*,³⁰ shows that ordinary sea-water contains about the same percentage of NaCl as the Nauheim baths, but is somewhat deficient in calcium chloride. Dr. A. Mayer²⁴ has adopted this suggestion in the preparation of artificial Nauheim baths, using sea salt as the basis and supplying the deficiency in the other salts by adding the commercial product.

The various formulae are not, however, devoid of danger. Muriatic acid is a powerful corro-

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The sive and liable to injure the skin when used in Artificial sufficiently large quantities to be effective. It Nauheim has also happened repeatedly that the hypo-Bath chloride of calcium has been employed by mistake instead of the calcium chloride. Johns Hopkins Bulletin¹⁸ reports such a case, in which the patient was able to get out of the bath without harm; the nurse, however, was seriously prostrated with bronchitis and laryngitis. Satterthwaite reports a similar case in the Post-Graduate.²⁵ Paine³¹ distinguishes between the artificial baths and the baths at Nauheim. These drawbacks are not the only ones. Broadbent, who made extensive use of this method, says: "It would be better, where it is desired to have a large amount of carbonic acid in the water, to make use of cylinders of the compressed gas, and allow it to pass through the water in the quantity desired." We can see from this remark that his results did not reach his expectations, after his experience at Nauheim. J. L. Stevens²⁶ was equally unsuccessful with Dr. Schott's formulæ. He concluded that "it [the Nauheim bath] has no advantages over the old-fashioned methods of treatment. No notable slowing of the pulse occurred, no appreciable diminution in the area of cardiac dulness."

To obviate the dangers of the hydrochloric acid and impure chemical ingredients, artificial

Nauheim salts have been prepared in which *The* the hydrochloric acid is replaced by solid discs of *Artificial* acid sodium or potassium sulphate. This, however, merely eliminates the danger of burns and *Bath* chlorine poisoning, but in most instances is just as inefficient as the older method.

The ideal carbonated bath is one in which the carbon dioxide is held in solution in the water and is only slowly given off. Thus alone is it possible to gradate the gaseous contents of the bath to the needs of the patient. In a bath prepared from chemicals introduced into the tub, there is for a brief period of time a violent ebullition of the gas at the points where the sodium bicarbonate dissolved in the water comes in contact with the acid or acid salt. As soon as the alkaline solution surrounding the acid has been decomposed and given off its carbon dioxide, the chemical action can only progress slowly by the gradual diffusion of the acid to portions of the alkaline solution not yet acted on, and very shortly after must cease entirely. If we try to distribute the chemicals evenly by agitating the water, all the gas is driven off. Manifestly a patient, to obtain any action from the gas, must be hurried into the bath, which with heart patients is surely an undesirable feature. On the other hand, if he delays too long the effervescence has entirely ceased. Nor can we in any way de-

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The termine the amount of gas given off at any time, *Artificial* so that even an approach to scientific treatment *Nauheim* is out of the question.

Bath The use of gas-generators, or even cylinders of liquefied gas, in which the gas is conducted into the bath directly, is no improvement either. The gas passes through the water in a stream of large bubbles, but it does not become diffused through the bath. Only the small bubbles of gas which are seen clinging to the body of the bather in a properly carbonated bath are capable of producing any physiological action, and this can be obtained only by previous solution of the gas.

We have spoken so far of the inability of baths prepared by these methods to do good, but there is yet a still more important feature, namely, that they can do harm.

Theo. Schott in the *Medical Record*⁸ says: "A violent escape of CO₂ causes shortness of breath and lowering of blood-pressure, indicating failure of heart force, while, per contra, the pulse and respiration rise, also indicative of cardiac failure."

T. E. Satterthwaite²⁵ describes some good results obtained by him, using a carbonated bath in which the CO₂ gas was mixed intimately with the brine by means of special machinery. It does not appear, however, from the description, that anything was attempted other than allowing

the liquid CO₂ to act on the water by its own *The pressure.* Heineman²⁷ says: "Carbonic acid *Artificial* gas must be mixed with the water; it is thus ren- *Nauheim* dered active, instead of simply allowing it to pass *Bath* over the body as in ordinary chemical efferves- cence, and, more important still, it is the only way of measuring the amount of CO₂."

The System Erlinger.—Realizing that all methods designed either to produce a certain amount of CO₂ in a bath, or to conduct CO₂ into a bath from a gas-generator or from a tank of compressed gas, failed to reproduce the conditions of the natural waters of Nauheim, experiments were conducted along entirely new lines for a long time, until an actually intimate admixture of gas and water was secured.

In this apparatus, the liquefied CO₂ passes into a chamber containing the brine solution. There, by means of paddles rotated by machinery, the gas and water are mixed. When the water prepared in this way is drawn into a tub, little bubbles of gas are seen clinging to the sides of the tub and slowly coming off from the surface. This uniform discharge of gas is maintained for a longer time than it is necessary to conduct the bath. So far, this is the only method (outside of the natural waters of Nauheim) which meets the requirements of a carbonated bath. There is no sudden discharge of gas, since it is in actual solu-

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The tension and can only be disengaged by an elevation *Artificial* in the temperature of the water or by mechanical *Nauheim* means. Such a bath, as has been tested by

Bath actual experiment, retains almost its entire amount of gas, even after 24 hours. The effervescence which occurs when the patient is immersed in the bath is due to the elevation of the temperature of the water by the body heat of the bather, to some extent also from the fact that the adhesion of the gas to the smooth sides of the tub is much greater than to the irregular surface of the skin, the diffusion currents and the diffusibility of the gas allowing the amount of the gas contained in the bath to diminish only very gradually.

The brine solution is prepared from the imported Nauheim salts if desired, or according to the formula of Dr. A. Mayer, with sea-salt as a basis.

The correct temperature of the bath is secured by the addition of hot water in certain proportions, the amount necessary being computed from tables, according to the respective caloric values of the carbonated brine solution and the hot water added.

It is thus possible to prepare accurately baths of varying strength, of saline and CO₂, and at any desired temperature.

The formulæ used are those secured from

analyses of Springs 7 and 12 of Nauheim. Further modifications are made by either diminishing or increasing the saline constituents of the *Nauheim* bath, by greater dilution, or by the addition of the concentrated mother-lye. The amount of carbonic acid gas can be varied from a feeble effervescent bath to the strongest current effervescent baths. Each bath is freshly prepared for the patient according to the prescription of the physician.

True, the other salutary features of a health resort, the entire relaxation from business, the purer air, suitable environment, etc., are entirely lacking. There are, however, sufficient reasons to justify the establishment of a bath even in a busy metropolis like New York. Financial or business reasons prevent many from going to Nauheim and seeking what may be for them the only means of relief, or even cure, from an otherwise speedily fatal disease.

To the physician, moreover, such an institution is both of interest and advantage. Their patients do not pass out of their hands, and they are able themselves to direct the baths and observe their effects. In a place like Nauheim, with its thousands of "Kur" visitors, it is not always possible for patients to receive the same careful attention which their own physician will devote to them.

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The In this institution we confidently believe that *Artificial* all objectionable features have been eliminated. *Nauheim* Couches are provided, so that patients can rest *Bath* at least one hour after the bath, and have a suitable massage administered, if advisable.

Those who are acquainted with Nauheim, we are sure, will appreciate these baths, and those who are skeptical will be convinced by trial.



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*Analysis of the Nauheim Mineral Waters.**

The amounts of solids are given in grammes as contained in 1000 grammes of water.

CONSTITUENTS.	SPRINGS FOR THE BATHS.	
	No. 7. Grosser Sprudel	No. 12. Friedrich Wil- helm Quelle
Chloride of Sodium.....	21,8245	29,2940
" Lithium.....	0,0492	0,0536
" Potassium.....	0,4974	1,1194
" Ammonium.....	0,0550	0,0712
" Calcium.....	1,7000	2,3249
" Magnesium.....	0,4402	0,5255
Bromide of Magnesium.....	0,0060	0,0083
Sulphate of Calcium.....	0,0347	0,0352
" Strontium.....	0,0390	0,0499
Bicarbonate of Calcium.....	2,3541	2,6012
" Magnesium.....
" Sodium.....
" Iron.....	0,0383	0,0484
" Manganese.....	0,0065	0,0069
" Zinc.....	0,0104	0,0089
Silicic Acid.....	0,0325	0,0213
Arseniate of Iron.....	0,00036	0,0002
Phosphate of Iron.....	0,00046	0,0007
Oxide of Copper, Chloride of Thallium, Oxide of Lead, Nitric Acid, Organic substances	Traces	Traces
Amount of solid constituents..	27,0886	36,1695
Absolutely free carbonic-acid gas	2,3764 = 1216,6 ccm	1,9777 = 1039,9 ccm
Semi-free carb. acid gas contained in the bicarbonates ...	0,7343 = 375,7 ccm	0,8123 = 416,2 ccm
The active carb. acid, i.e., the free and semi-free together ..	3,1107 = 1592,3 ccm	2,7900 1456,1 ccm
Temperature { Celsius.....	31,6°	35,3°
Fahrenheit....	88,88°	95,54°

*From *Bad-Nauheim; Its Springs and Their Uses*, by J. Groedel.



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